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ABSTRACT

Students pursuing Australian studies should be given every possible opportunity to work with materials produced in Australia. There is a substantial and growing list of good curriculum software written within Australia and from an Australian perspective which can add interest and excitement to Australian geography classrooms. Computers can be used to help students learn information and develop skills. Two simulations that focus on developing map skills are "The Great Australian Car Rally" and "Dirigible." Programs such as "Solar House"; "Bush Rescue"; and "Climate" teach a range of fundamental principles and then give students the opportunity to apply those principles to situations in which a clearly defined "right answer" can be observed. "The Farming Game"; "Pisces"; and "The Isle of What?" require students to consider geographic factors when planning land use to arrive at the "best possible outcome" for the computerized simulations. "Australia--A Profile"; "Enter Geography"; "Home Town"; "One World Data Base"; "People Pyramids"; "Disasters"; and "The Great Disaster Data Base" are all database programs related to the study of Australia. "Industrial Location" and similar software packages are spreadsheet programs that allow for analysis of geographic data. These programs, and others like them, can help to brighten our classrooms and draw the attention of our students to aspects of Australian geography. Information on the developers of the highlighted software is provided, as are print images of the screens of some programs. (GEA)

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AUSTRALIAN COURSEWARE IN GEOGRAPHICAL EDUCATION

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by

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Paper presented to the International Symposium on Courseware in Geography, Nurenberg, West Germany, March 30 - April 3, 1989.

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Abstract

This paper describes a number of courseware packages produced in Australia. These packages may be used to achieve five educational objectives which may be attained through computer assisted teaching and learning: learning information and developing skills, finding right answers, finding best answers, handling large amount of information and processing numerical data. The choice of programs reflects the variety of microcomputers in use in Australian schools. While the situation differs between states, the following table may be taken as representing the choice of computers in the country as a whole:

Primary Schools		Secondary Schools	
60%	Apple II	80%	Apple II
3%	Apple Mac	30%	BBC
35%	BBC	10%	IBM/clones
2%	others (C64, Microbee etc.)		

Until about five years ago, the emphasis on computer use in geography, in these Australian schools in which such activities took place, at all, was on software imported from the USA (for Apple machines) and from the UK (BBC machines). More recently, software packages have been developed in increasing numbers within Australia. Development has been undertaken by branches of state government education departments (such as the Angle Park Computing Centres in South Australia and the Computing Centre of the Western Australian Ministry of Education) and by commercial publishing houses such as Jacaranda Software.

There are a number of reasons why geography teachers in all states should consider introducing at least some of the software packages which have been developed within Australia into their Australian geography programmes. Some of these reasons are:

- An important aim of the various education systems in Australia is to help students to enjoy an easy relationship with computers. Geography makes a contribution to the achievement of this aim when students use computers as just one more tool among many in their studies.

- Students pursuing Australian studies should be given every possible opportunity to work with materials produced in Australia. There is an inherent contradiction in trying to develop students' Australian consciousness using materials which originate overseas.

- Computer software is very expensive to develop. The diffusion of software between states appears at present to be very haphazard and inefficient. The nationwide use of materials has considerable cost advantages for both producers and consumers.

- The materials produced in each state sometimes reflect those matters which are of particular importance in that state. While some reviewers have suggested that such materials maybe less useful to interstate students, the aims of Australian studies would be advanced by students examining those matters which are regarded as being of importance to those in other states.

There is now a substantial and growing list of good curriculum software written within Australia and from an Australian perspective which can add interest and excitement to Australian geography classrooms. While a number of examples are used in this article, there are now so many programs that I cannot attempt to list them all. Indeed, I should be very grateful to anyone who draws my attention to other sources of geography software or software packages that merit greater attention.

Subject specific software is frequently subdivided into five different types. These are: electronic blackboard programs, tutorial programs, simulations, data bases, and statistical or number crunching programs.

The category into which any single piece of software falls may vary according to the use made of it in any particular classroom. Thus, a program may be classified as an "electronic blackboard" if run on a single machine at the front of the classroom as part of a largely expository lesson by the teacher, while the same program would be classified as a "tutorial program" if run by a student or group of students working independently of the teacher. Furthermore, there is an increasing number of software packages which include examples of several of these program types. In order to avoid any suggestion of prescription of how the programs should be used, I have classified the packages to be mentioned in this article according to the highest levels of educational aims in which students may be expected to develop from the following list:

- Learning information and developing skills
- Finding right answers
- Finding best answers
- Handling large amounts of information
- Processing numerical data

Learning information and developing skills

One of the earliest uses of computers in geography teaching was the quiz type of program in which students were asked to name or find places marked on a map. The computer kept the score and students could measure their progress in learning names and locations or using grid references. Such programs still have a place when one of the aims is for students to learn locations, and a number have been produced by companies such as

Jacaranda and by Elizabeth Computing Centre in Tasmania and Angle Park Computing Centre in South Australia.

Although these "drill and skill" programs do have considerable motivational appeal, students' knowledge of locations and abilities in map reading can also be developed by computerised simulation games. Two simulations which develop these skills are *The Great Australian Car Rally* and *Dirigible*.

The Great Australian Car Rally presents students with nine stages of a car rally through eastern and central Australia. In planning their journey, students are required to calculate distances between locations, estimate speed of travel bearing in mind the terrain through which they will travel and decide how much fuel will be needed. After the computer has informed participants of their next leg of the race, students leave the computer to carry out their calculations using either atlas maps or, preferably, detailed road maps. When the planning task has been accomplished, each team returns to the computer to enter details of its decisions. Once the journey begins, random factors such as breakdowns or the results of miscalculations due to lack of fuel are introduced and responses must be entered. On completion of the leg, a report is presented and preparation for the next leg begins.

This program has considerable potential for helping junior secondary students to develop their map reading skills related to location and distance. Also it encourages them to investigate the different landscapes through which the rally passes, as well as the effects of vehicle weight and road condition on the amount of fuel needed for the journey. In this way, the program introduces ideas of cost-distance and time-distance as well as linear distance.

Dirigible, in which students are asked to fly a hot air balloon across various types of terrain as shown on a series of coloured relief maps, is published as part of a science package. Despite this, the need for students to base almost all their decisions on their map interpretations makes this package a valuable addition to the geography department in any school. Successful navigation requires students to:

- interpret simple map colour keys on the relief maps provided;
- use directions in terms of the points of the compass;
- use the grid system to locate points on the map; and
- record information on charts.

However, the navigation is not just two dimensional like most of the map work carried out in schools. In order to avoid accidents, students must adjust altitude to take the relief of the land into account. This requires them to think of the landscape three-dimensionally. This program, too, is best used by students co-operatively as altitude, wind speed and direction have to be considered in making each decision. Another advantage for many schools is that the discussions can be undertaken away from the computer.

Finding right answers

While the programs described above probably make their greatest contribution by developing students' knowledge and skills, there are yet others which do this and more. Programs such as *Solar House* and *Climate* teach a range of fundamental principles and then give students the opportunity to apply those principles to situations in which a clearly defined "right answer" can be observed.

Solar House is based on the idea of passive solar heating whereby various design techniques are used to produce more comfortable temperatures inside a house during summer and winter without increasing building costs or using more energy in the form of electricity or gas. Students are taught the importance of siting and shading from evergreen and deciduous trees and verandas. They are then given the task of selecting one of four locations in Western Australia which vary widely in latitude, and are given information on average temperatures and the path of the sun's rays for each season. They are told what constitutes a comfortable temperature in their chosen location. With this information, they must then manipulate the site of their house within its plot, and design the verandas and landscaping. The computer then produces a report on the effectiveness of the design in achieving comfortable temperatures. The report includes graphs of average daily temperatures inside and outside the house for each season so that students may see how effective their design has been. After the report, the student is returned to the design stage for further amendments.

Not only does this program help students in their mapping skills, but it also develops their understanding of the effects of latitude, aspect, and season as well as requiring them to apply these understandings in their own designs.

A similar strategy is adopted in another Western Australian production, *Climate*. This is a suite of programs designed to help students appreciate the range of factors which influence the climates of the continents and then relate these factors to the climates experienced in Western Australia. The learning aims of the first part of the suite are stated in the *Teacher's Guide* as being for students to learn that:

- temperature decreases with increasing latitude;
- temperature decreases with increasing altitude;
- rainfall decreases with distance from the coast in the direction of the prevailing wind;
- rainfall increases as the temperature of the ocean currents over which the prevailing wind blows, increases; and
- rainfall increases on the windward side of mountain ranges and decreases on the leeward side.

With these aims clearly stated, the first five sub-programs present students with a series of simulations in which an imaginary land mass of continental size is manipulated in an attempt to place it appropriately on the globe to achieve given "target" climatic features for each of two cities. In the first simulation, the land mass is moved north or south of the equator in 10 degree increments in order to achieve specified average annual temperatures. When the students have decided where the land mass should be located, they may request a "report" in the form of a graph plotted on the screen to show how close they have come to discovering the appropriate location. When finally they have located the land mass so that the two cities have temperatures similar to those presented as the target, a final report may be requested to identify the ideal location, to inform the student of the number of attempts made and to give a score based on the accuracy with which the temperatures were matched. Having experimented with the location of the land mass, with the help of the worksheets supplied, students may then attempt ten "problems" which encourage them to make generalizations about the real countries of the world and to undertake further investigations using reference books and atlases. Finally, they are encouraged to undertake further research on the reasons why there is a relationship between latitude and average temperatures.

Students may then move on to investigate the relationships between:

- altitude, latitude and temperatures;
- prevailing winds and rainfall;
- ocean currents and rainfall; and
- mountains and rainfall.

In each of these sections, the simulations become progressively more complex with the addition of new factors to be taken into consideration. Finally, after they have been introduced to all the various factors which influence climate, students are asked to design a complete climate for the imaginary landmass. Once again, targets are set randomly for the temperature and rainfall averages for the two cities. Students are able to alter all the factors affecting the climate of the continent: the latitude, the temperature of the surrounding ocean currents, the direction of the prevailing winds, and the height and east-west position of the mountain range.

Figure 1 shows a screen in which the student has attempted to locate the land mass. The box in the top left hand corner of the screen shows the four previous decisions made. The lower left hand box is the "report" on the implications of these decisions. The reader may like to compare the "report" with the "target" and consider what the next decision should be.

Finally in this section, mention must be made of one of the most complex simulation packages yet published, *Bush Rescue*. This package offers students the opportunity to develop such a wide range of skills that it is difficult to know where to begin. The simulation places a group of students at the start of an adventure. They have decided to take a camping trip to a national park. This involves the study of timetables for bus and train before the computer simulates a Viatel terminal. I have to confess that I took six attempts before I managed to book train and bus tickets which would get me to the camp site - my carelessness, no fault of either the timetables provided or the booking system. Having reached the camp site, and enjoyed a good night's sleep, the adventurers become involved in helping to find an injured caver. This section of the package is presented as a conventional adventure game, but with the additions of logic tests (how do you use six logs of different lengths to make a bridge across the river?) and a maze which has to be crossed without the benefit of the plan view of paper and pencil mazes. The hapless

travellers have to use trial and error to find a way through, and are advised to construct a map of the route to aid the return journey.

The implications of this exercise alone for our students' map understanding are immense and do not need to be explored further here. Having found the caver, our heroes must then return to the campsite to navigate a rescue helicopter back to the scene of the accident. At last the conventional geography skills of route finding on a topographical map may be seized upon, although even here, the contours are given more than usual importance since, as in *Dirigible*, the helicopter must not crash into a hillside, and neither must it fly higher than 80 m. If all this seems enough to stretch even the most broad minded interpretation of geography, provision is also made in the package for students to write up their experiences in the form of a newspaper front page article which is formatted and printed out to look like the real thing.

"What's all this got to do with Australia?" you may ask. Well, the tourist guide and climatic information in the program are undoubtedly Australian, as are other features encountered on the journey. Students are invited to explore all the evidence which confirms the Australian origins of the location and to list those aspects which make the adventure culturally specific.

Finding the best answer

The simulations described in the previous section encourage students to apply skills to a problem in order to reach a predetermined solution - the right answer. There are many situations in real life in which there is no right answer, but which involve participants in weighing up information in order to reach the best possible response within the constraints given. Such simulations vary in the complexity of both the decisions required and the information and concepts required.

The Farming Game is a simple simulation in which students are required to run a mixed farm located in the south western corner of the Australian wheat-sheep belt. The students are given background information from within the program, including a map of the mixed farming region as shown in Figure 2, although it may be reasonably expected that most students will study the wheat-sheep belt in much more detail at some point in their lower secondary geography course. They are told that their incomes are influenced by such factors as weather, pests, disease and changing prices but that, although they cannot control

these factors, they can reduce their impact by careful choice of land use. The landuses are barley, wheat, oats, cattle and sheep and the students must decide which to allocate to each of seven paddocks for a ten year period. Depending on the weather, prices and random events, their choices result in an annual income and after seeing their income for the current year the students can then decide how to allocate their land for the next year. At the end of the decade, they can review their income.

While *The Farming Game* concentrates on the profit gained by the farmer, with no mention of the possibility of overgrazing or overuse of a single crop, *Pisces* provides the opportunity for students, working in groups, to explore the relationships between the short term needs of a fishing community and the long term needs of the ocean ecosystem.

Whereas in *The Farming Game* students work either alone or in groups to plan a single farm with constant use of the computer, for *Pisces*, they are divided into four village groups, each of which contains boat owners, storekeepers and Village Council members. Only a single computer is needed in the class. Each village must take responsibility for the management of its own fishing ground and each Village Council is responsible for the general welfare of its village. A co-ordinator decides for how many seasons the simulation should run, the rate at which the fish reproduce each season, the demand for fish, and the fixed costs of each boat and each warehouse. The amount of fish to be caught each season is decided by the boat owners in consultation with other groups in the village, and is affected by the number of boats used and the size of the nets. The Village Council tries to ensure a regular income for the whole village by placing a levy on the profits of the boat owners and the storekeepers. The income to each village is determined by the volume of open market sales of fish but, in addition, each village must ensure the long-term viability of the fishery and this can only be achieved if the village maintains a balanced economy and adopts a policy of responsible ecological management.

The simulation may appear complex when described on paper since the interactions of the decisions of the various groups involved can create a large number of variables. However, the software itself is far from complex. In the context of the game, each group is concerned with its own interests and with the long term welfare of the whole village and students' appreciation of the need to maintain a balanced economy and maintain fishery stocks in the long term, develops with each season played.

The Isle of What? is a more complex package which once again requires that students work in groups which interact to create a land use plan for an imaginary island. The island has been surveyed as shown in Figure 3 and found to include fifteen ecosystems including a swamp, foredunes, a mudflat, rain forest, heathland, floodplain, gentle mountain slopes, steeper slopes, a volcanic regions, rolling hills and a rocky ridge. Colour slides are provided to illustrate each of these, as is information on the average slope, soil texture, depth, fertility and drainage, flood and slump probability and erosion risk. Students are allocated to various land-use development roles including high rise flats, canal estate, wood pulp factory, forestry, horticulture, grazing, urban, waste disposal, camping ground, feedlot and scenic roads. Students must decide which of the fifteen ecosystems are most capable of supporting their allocated land use and having interrogated the computer's land capability assessment system, make an appropriate proposal. Some students are allocated to the role of "conservationists" who do not need to examine land use capability, but must be able to argue persuasively against changing the ecosystems.
Having considered land capability, the students are then allocated to various district councils to consider the proposals. An interesting aspect of reality is introduced by allowing students to retain their previous roles as developers while serving on the councils, with all the conflicts of interest which are involved. At this stage, the councils assess the proposals with the help of the computer which provides information on the suitability of each area in the light of land use proposed for adjacent areas. Finally, there is provision for a Court of Appeal to examine the wisdom of the decisions reached.

It is significant that this program should have been produced in Victoria in view of the large proportion of that state which has already been developed. Students in other states in which pressure on land has yet to reach the levels suffered in Victoria may be regarded as having a special need to be introduced to the principles involved. Perhaps, however, the greatest benefit of this program is that the package assumes that the information contained may be ignored as a valid part of the simulation. Councillors may decide to accept landuses against all the evidence provided by the computer because they may see benefits which have not been quantified. This facility is important in that it simulates the ways in which decisions are frequently reached in the real world and, thus, makes a useful contribution to developing political literacy within geography work programmes. It also helps students to learn to differentiate between information which can be calculated from measurable data and those aspects which are matters for judgement and opinion. Finally, the land capability assessment sections of the program can be changed by the teacher to enable them to be used to assess land use in a local area following collection of data in the field.

Handling large amounts of information: Data bases

A data base is simply an organized collection of information which may be imagined as an electronic card filing system with all the cards cross-referenced. While all computers have a data management system available for them at low cost and it is quite possible for students and teachers to enter data into their computers as an aid to analysis, such data entry is a long and tedious process. There are many advantages in geography teachers using data bases which have already been prepared and, if they or their students become aware of some bias on the part of the compilers in the information which has, or has not, been included, then a valuable lesson on the use of data bases has been learned. Similarly, data bases which have been prepared for use in the schools of one state may be useful in other states both as information on another area of Australia, as sources of information for interstate comparisons, and as examples of information which we should perhaps collect for our own states.

Mention has already been made of the data base of climatic statistics for 120 places in Western Australia which forms part of *Climate*. This data base includes information on latitude, longitude, average yearly maximum temperature, annual rainfall, average number of rainy days and if or when the place experiences a rainy season. The data can be searched with the usual range of descriptors and the findings can be presented in four ways:

1. plotted on a map of Western Australia;
2. plotted on a map of the south-west of WA;
3. printed on the screen as a list with all the data on each place presented; and
4. printed as a hard copy list.

While the benefits to students in WA are obvious, those in the other states may use the data base to learn something about the largest state as well as to test hypotheses as presented in worksheets included in the package such as "Places near the Equator are usually fairly hot and the further a place is from the Equator the cooler it becomes".

For those who wish to explore the social structure of Australia, *Australia - A Profile* is a prepared data base which includes information taken from the Census including population, age distribution, ethnic origin, income, housing, occupation, unemployment and

industrial and agricultural activities. The data base allows students to obtain a synopsis of information on the various regions of Australia as well as to compare individual regions with the national figures. Thus, students may compare the social structure of their own areas of Australia with that of other specified areas or may search to find where else in Australia there are social structures similar to that of their own area.

The *Enter Geography* data base has been prepared for those who wish to examine the range of accommodation types available on the Gold Coast and in Cairns, as part of their geographical studies.

Data bases do not need to be about information distant from students' own experiences. *Home Town* is a data base package which has been designed to encourage students to create their own data base on the social structure or other aspects of their own home area. The package encourages students to decide on some aspect of their home area on which they would like to carry out a survey. It includes an outline survey questionnaire designed to match the data base fields in which the first thirteen questions have been specified and a further nine may be created by the students themselves.

The "fixed" questions refer to: sex, age, marital status, place of birth, residence five years ago, current employment, current occupation, means of travel to work/school, distance to work/school, type of residence, size of residence, occupier status, and ownership of luxury goods.

Students may add other questions regarding shopping habits, opinion polls, values surveys, use of community facilities or material aspirations.

Once the questionnaires have been administered, students may enter the data into the data base and proceed to interrogate it in the same manner as in *Australia - a Profile*. Since information on up to 800 respondents can be entered into the data base, a class of thirty students could each administer the questionnaire to about twenty-five respondents, which would entail approaching ten average households. Analysis of the findings of such large numbers as part of a school exercise would be almost impossible without the aid of a computer. With it, students are given the power to investigate aspects of their local area in a way never before possible. Perhaps it would not be too fanciful to suggest that schools in different parts of a town, a state or even Australia might be able to design and administer the same questionnaire and investigate the different responses received.

Finally, since it is the contention of this article that students should use Australian software as far as possible, and that Australian studies includes comparing Australia with other countries, mention must also be made here of other excellent data bases such as *One World Data Base* (which was reviewed in this journal in 1986), *People Pyramids, Disasters* and *The Great Disaster Data Base*. Each of these data bases includes information from many countries and enables Australian students to investigate aspects of Australia by comparison with others on a wide range of criteria. *People Pyramids* is a data base containing demographic information on each of the countries of the world. Students are not only able to access this information, but also create population profiles for the countries and to project these profiles to future years with various assumptions of natural growth rates and migration.

Processing numerical data

While *People Pyramids* handles the demographic information as a data base, it is more usual for numbers to be handled in spreadsheets in order that they may be subjected to mathematical manipulations. Once again, it is quite possible for teachers and students to use any spreadsheet management program to create their own spreadsheets of information collected from field work activities or library research. However, it is more convenient when spreadsheets are available already created for use in the classroom either as examples or to save keyboard time. *Industrial Location* is such a spreadsheet. Figure 4 is a map of the imaginary country of United Lysistra which has decided to build an iron and steel plant to overcome reliance on imported iron and steel products. Students are informed that their company has been given the opportunity to build and operate the plant and that they must choose the most profitable site for the plant. In practical terms, this means finding the least cost location. In reaching a decision about where the plant should be built, students have to consider transport costs, raw material costs and labour costs. In addition they must bear in mind the fact that changes in these costs, either in terms of their unit costs or the contribution of each cost to the overall cost of the product, may change the location of the least-cost site.

Figure 5 is a copy of the spreadsheet information provided in the pack. In this simulated decision-making activity, it is assumed that the site for the iron and steel plant will be one of the four main cities of United Lysistra. An examination of the spreadsheet reveals that the city of Nyala is the least cost site, but students are encouraged to ask the question,

"Why is Nyala the least cost site?". Further examination reveals that Nyala's central location with respect to the raw materials and markets gives it lower costs than the other cities. So far, the decisions on selecting the least cost location may be made easily without "hands on" work with the computer. However, having decided that Nyala is the least cost location at current raw material costs and relative quantities, the spreadsheet enables students to consider the implications of changes such as a three-fold increase in the cost of transporting limestone, or new technology which reduces the quantity of coal needed to smelt a given quantity of iron ore. To perform the calculations required to produce new total costs of production manually would be both tedious and time consuming, but the number crunching capacity of the computer makes such a task easy. Furthermore, this ease encourages students' creativity since they are not discouraged from asking large numbers of "I wonder what would happen if ...." questions. The manual which accompanies this program suggests that students can go also use the spreadsheet to investigate the effects of changes in water costs, to the quantity of steel produced, in labour costs, in power costs, in the demand for steel produced both for internal and export markets, and in mineral deposits.

So far, the simulation suggested in the package is based on this imaginary country, but once the principles are grasped, students are encouraged to investigate whether Australia's iron and steel plants are located at the least cost sites and if this is not the case, to research reasons for locating the plants in potentially uneconomic locations. Since the basic costs for producing steel in United Lysistra are based on figures provided by BHP Australia, students are in a good position to consider the Australian steel industry, while the use of the spreadsheet provides them with a powerful tool to undertake many enquiries concerning other industrial locations in Australia.

This package does not only give a prepared spreadsheet on the steel industry. The disk supplied in the package also includes spreadsheets of climatic data, irrigation water supply and population. Climatic data on monthly average evaporation, rainfall and temperatures, from which annual total and average figures are calculated by formulae, for all eight Australian capital cities are provided. The sources of irrigation water for each state of Australia are provided with instructions for rapid updating and saving under a different name to allow comparisons between years. Finally, information on the total population, life expectancy, literacy rates, death rates and migration for 37 countries of the world is provided to allow international comparison.

Frequently, teachers and students may create their own spreadsheets to handle field work data and may incorporate simple formulae to aid in analysis. Some studies, however, may require levels of understanding greater than may reasonably be expected of many students. When the range of information must also be analysed using a number of complex formulae, the combination of tutorial program and prepared spreadsheet can be useful. This is the case when students wish to calculate the volume of soil which may be expected to be lost from a given area of land under different types of land use using the *Universal Soil Loss Equation*. In the package of this name students are led through a detailed description of those factors which influence the speed of soil erosion by water, rainfall, soil texture, soil structure, soil organic matter content, slope length, slope steepness, type of crop management, and conservation practices employed.

Each of these measures are reasonable data for students to collect and calculate themselves in the field and the geography room. *The Isle of What?* package also provides all the data needed. They are then asked to enter data for each of the factors and the computer then carries out the complex calculations required to give the composite factors required by the Universal Soil Loss Equation. The Equation is then applied to reveal the average annual soil loss from the area, expressed in tonnes/hectare/year. Once a figure is calculated as to how much soil may be expected to be lost, the question arises as to whether that loss is acceptable, bearing in mind that soil erosion is a natural part of all land ecosystems. Soil loss tolerance is defined in the package documentation as the maximum rate of annual soil erosion that will permit a high level of crop productivity to be obtained economically and indefinitely. Implicit in the definition is the desire that there should be no loss of productive capacity of the soil in the longer term. The program reveals the soil loss tolerance and this may be compared with the potential soil loss under the prevailing management conditions. This information enables students to investigate how potential soil loss and soil loss tolerance may be brought closer together through changing soil management practices and gives their field work skills great practical applicability. Once again such activities in their geography lessons demonstrate how computers may be used in real-world decision making.

Conclusion

These are just some of the computer programs and packages which can help to brighten our classrooms and draw the attention of our students to aspects of Australian geography. I would not advocate that anyone should try to incorporate all. For one thing, few schools have a sufficient range of machines. Many readers will already be using some of the programs mentioned here and will, I hope, be reaching for their pens to send the editor descriptions of their own favourite Australian programs. For those who would like to introduce more Australian software into Australian studies in geography, the details of the programs I have described are provided below.

Computer Software

Australia - A Profile (1984) Active Learning Systems, P.O. Box 197, Indooroopilly, 4068. (Microbee, BBC, Apple II, IBM PC, Commodore 64)

One World Countries Database (1984) Active Learning Systems, P.O. Box 197, Indooroopilly, 4068. (Microbee, BBC, Apple II, IBM PC, Commodore 64)

Bush Rescue (1987) Jacaranda Software, GPO Box 859, Brisbane 4001. (Apple II, BBC)

Climate (1985) Wesoft Educational Software, Schools Computing Branch, Education Department of Western Australia, 151, Royal Street, East Perth, 6000. (BBC)

Dirigible (1984) Wesoft Educational Software, Schools Computing Branch, Education Department of Western Australia, 151, Royal Street, East Perth, 6000. (BBC)

Disasters (1986) Satchel Software, Angle Park Computing Centre, Cowan Street, Angle Park, 5010. (BBC)

Enter Geography (1986) Division of Curriculum Services, Department of Education, PO Box 33 North Quay. (IBM PC)

Home Town (1984) Active Learning Systems, P.O. Box 197, Indooroopilly, 4068. (Microbee, BBC, Apple II, IBM PC, Commodore 64)

Industrial Location (1986) Satchel Software, Angle Park Computing Centre, Cowan Street, Angle Park, 5010. (BBC)

People Pyramids (1985) Satchel Software, Angle Park Computing Centre, Cowan Street, Angle Park, 5010. (BBC)

Pisces (1984) Curriculum Research and Development Group, College of Education, University of Hawaii and the Curriculum Development Centre, P.O. Box 34, Woden, ACT 2606. (BBC, Apple II)

The Farming Game (1985) Satchel Software, Angle Park Computing Centre, Cowan Street, Angle Park, 5010. (BBC)

The Great Australian Car Rally (1985) Goodison Software, Lot 2 Monument Road, Kilmore, Victoria 3601. (Microbee)

The Great Disasters Database (1987) Dr. Colin Macpherson, The Centre for Computer Education, Hawthorne Institute of Education, 442, Auburn Road, Hawthorn, 3122. (IBM PC, IBM JX, Apple IIe)

The Isle of What? (1981/1985) GTAV, 464B Glenhuntley Road, Elsternwick, 3185. (BBC, Apple II)

Solar House (1987) Wesoft Educational Software, Schools Computing Branch, Education Department of Western Australia, 151, Royal Street, East Perth, 6000. (BBC)

Universal Soil Loss Equation Package (n.d.) Iaian Grierson, Roseworthy Agricultural College, Roseworthy, 5371. (IBM PC, Apple II)

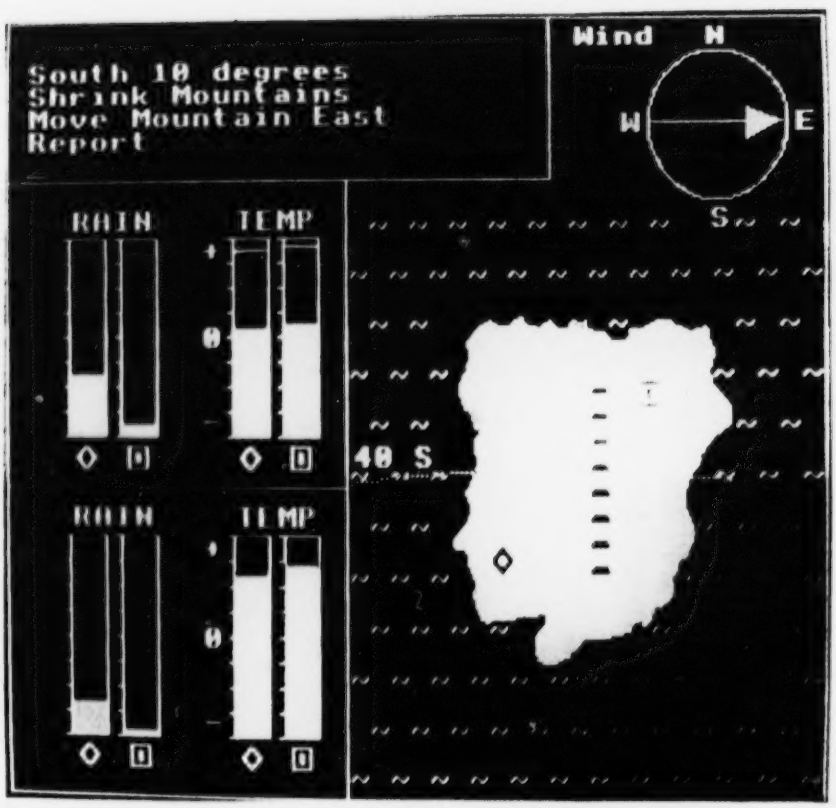

Figure 1: A screen for *Climate*

Figure 2: The background information screen from *The Farming Game*

The Isle of What?

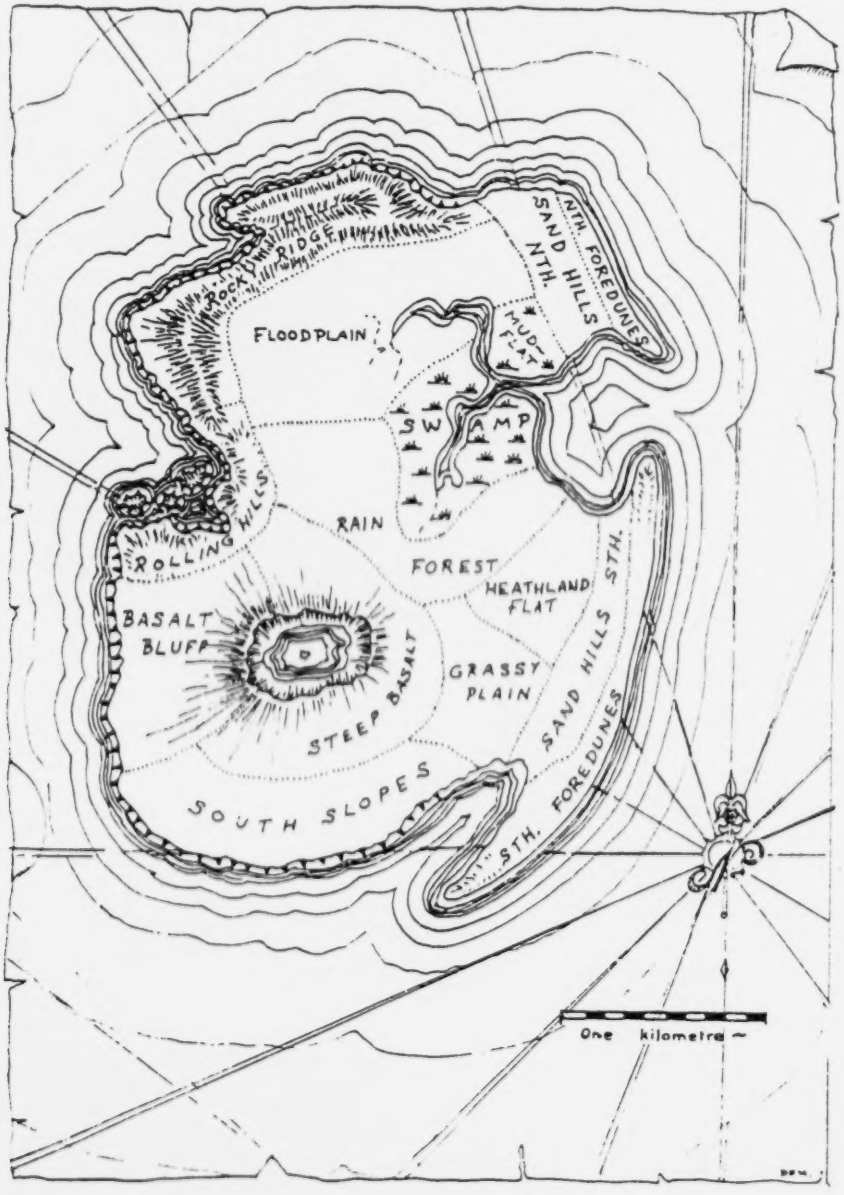

Figure 3: *The Isle of What?*

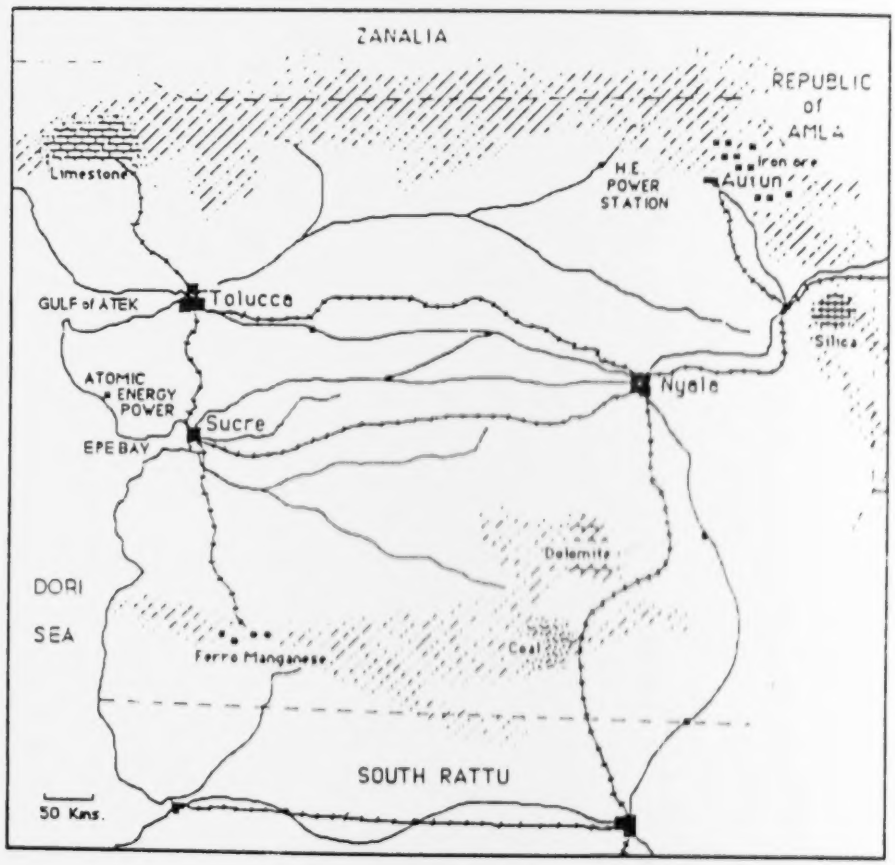

Figure 4: United Lysistra

STEEL PLANT LOCATION SIMULATION tot.cost values are in $,000's

PRODUCTION COSTS PER 1000000 TONNES			AUTUN		NYALA		SUCRE		TOLUCA	
RAW MAT.	Quant.		lt/cost	Tot.cost	lt/cost	Tot.cost	lt/cost	Tot.cost	lt/cost	Tot.cost
Iron ore	1.6	tonnes	36	57600	36	57600	36	57600	36	57600
Coal	1		90	90000	90	90000	90	90000	90	90000
Dolomitee	0.18		24	4320	24	4320	24	4320	24	4320
Silicon	2E-3		600	1200	600	1200	600	1200	600	1200
Limestone	0.2		20	4000	20	4000	20	4000	20	4000
Ferro manganese	7E-3	tonnes	600	4200	600	4200	600	4200	600	4200
WATER	3	kilolit	2	6000	2	6000	1	3000	1	3000
ELECTRICITY	0.351	meg.wat	5	1755	6	2106	4	1404	4	1404
RATES and TAXES	250	HA.	180	45	280	70	250	62.5	200	50
LABOUR	4000		24000	96000	27000	108000	27000	108000	26000	104000
TRANSPORT	C./T./K.		Dist.K.	Tot.cost	Dist.K.	Tot.cost	Dist.K.	Tot.cost	Dist.K.	Tot.cost
Iron ore	0.1	$	0	0	350	56000	850	136000	850	136000
Coal	0.15		650	97500	300	45000	800	120000	800	120000
Dolomite	0.3		550	29700	200	10800	700	37800	700	37800
Silicon	0.6		170	204	170	204	670	804	670	804
Limestone	0.25		1050	52500	700	35000	350	17500	200	10000
Ferro manganese	0.6		1065	4473	715	3003	215	903	365	1533
TOTAL PROCESSING COSTS				449497		427503		586793.5		575911

DISTRIBUTION COSTS

MARKET	Quan.T.	C./T./K.		Dis.K.	Tot.cost	Dist.K.	Tot.cost	Dist.K.	Tot.cost	Dist.K.	Tot.cost
Autun	40000	0.8	$	0	0	350	11200	850	27200	850	27200
Nyala	200000	0.8		350	56000	0	0	500	80000	500	80000
Sucre	200000	0.8		850	136000	500	80000	0	0	150	24000
Tolucca	300000	0.8		850	204000	500	120000	150	36000	0	0
R.ofAMLA	130000	0.8		550	57200	600	62400	1100	114400	1100	114400
S.RATTU	130000	0.8		750	78000	500	52000	1100	114400	1100	114400
TOTAL DISTRIBUTION COSTS					531200		325600		372000		360000
TOTAL OF ALL COSTS					980697		753103		958793.5		935911

Figure 5: The spreadsheet of steel costs in United Lysistra